

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date
22 January 2004 (22.01.2004)

PCT

(10) International Publication Number
WO 2004/006657 A1

(51) International Patent Classification⁷: **A01H 5/00**

Att.
Queensland 4072 (AU). **MCQUALTER, Richard, Bruce** *6-6*
[AU/AU]; 9 Alonga Court, Kallangur, Queensland 4503
(AU).

(21) International Application Number:
PCT/AU2003/000903

(74) Agent: **HUGHES, Edward, John, Langfo; Davies Colli-
son Cave, 1 Little Collins Street, Melbourne, Victoria 3000**
(AU).

(22) International Filing Date: 11 July 2003 (11.07.2003)

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC,
SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(26) Publication Language: English

Published:

(30) Priority Data:
60/394,869 11 July 2002 (11.07.2002) US

Att. with international search report

(71) Applicants (*for all designated States except US*): **BUREAU OF SUGAR EXPERIMENT STATIONS** [AU/AU]; PO Box 86, 50 Meiers Road, Indooroopilly, Queensland 4068 (AU). **THE UNIVERSITY OF QUEENSLAND** [AU/AU]; St Lucia, Queensland 4072 (AU).

Att. For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **BRUMBLEY, Stevens, Michael** [AU/AU]; 3 Carlie Court, Redbank Plains, Queensland 4301 (AU). **MURKIN, Matthey, Peter** [AU/AU]; 25 Barmore Street, Tarragindi, Queensland 4121 (AU). **CHONG, Barrie, Fong** [AU/AU]; 10 Emmett Street, Wynnum West, Queensland 4178 (AU). **PETRASOVITS, Lars, Arved** [AU/AU]; 224 Lower Hardgrave Road, West End, Queensland 4101 (AU). **NIELSEN, Lars, Keld** [DK/AU]; The University of Queensland, Building 69, Room 723, Brisbane,

(54) Title: TRANSGENIC PLANTS USED AS A BIOREACTOR SYSTEM

WO 2004/006657 A1

(57) **Abstract:** The present invention relates generally to the use of plants as bioreactors for the production of molecules having useful properties such as *inter alia* polymers, metabolites, proteins, pharmaceuticals and nutraceuticals. More particularly, the present invention contemplates the use of grasses, and even more particularly C4 grasses, such as sugar-cane, for the production of a range of compounds such as, for example, polyhydroxyalkanoates, pHBA, vanillin, indigo, adipic acid, 2-phenylethanol, 1,3-propanediol, sorbitol, fructan polymers and lactic acid as well as other products including, *inter alia*, other plastics, silks, carbohydrates, therapeutic and nutraceutical proteins and antibodies. The present invention further extends to transgenic plants and, in particular, transgenic C4 grass plants, capable of producing the compounds noted above and other products, and to methods for generating such plants. The ability to utilize the high growth rate and efficient carbon fixation of C4 grasses is advantageous, in that it obviates the significant growth penalties observed in other plants, and results in high yields of desired product without necessarily causing concomitant deleterious effects on individual plants. In addition, the C4 grass, sugarcane, is particularly advantageous, as in addition to the features common to all C4 grasses, this plant accumulates sucrose. This sucrose store provides a ready supply of carbon based compounds and energy which may further obviate any deleterious effects on the growth of the plant associated with the production of the product. The present invention provides, therefore, a bioreactor system comprising a genetically modified plant designed to produce particular metabolic or biosynthetic products of interest.